Photon Mapping

CAP 5705 Computer Graphics, Fall 2015

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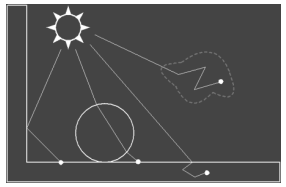
Background

- Photon mapping is an elegant way to solve the limitations of Ray tracing. Before any standard Ray Tracing is done, light (photons) is sent from the light sources in the scene and allowed to bounce around, then stored in a "photon map". The photon map stores final positions of the photons as well as color and incoming direction.
- After the map is built, standard Ray Tracing is done, and for each bounce the photons near the location of the bounce are essentially treated as small light sources. This allows us to generate complete light paths that would not be normally considered. It also helped us simulate diffuse inter-reflections by allowing the light to bounce around the scene, grabbing color at each step. To perform this, photons were stored at each diffuse bounce, but were still allowed to continue on their path, until they got absorbed.

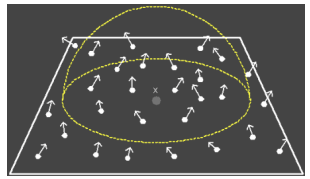
Approach and Implementation

We utilized the two pass algorithm, where the first pass builds the photon map by tracing photons from each light source. And the second pass renders the scene using the information stored in the photon map. **First Pass of the algorithm -** The first pass of the algorithm consist of 3 steps: (1) Photon emission-It is the process of emitting discrete photons from the light sources and tracing them through the scene (2) Photon scattering : The emitted photons from light sources are scattered through a scene and are eventually absorbed or lost. (3) Photon storing - We stored the position, color and direction of photons in the scene. **Second Pass of the algorithm -** In the second pass of the algorithm we rendered the scene with the help of the photon map built in the first pass. In this step of the algorithm, the photon map created in the first pass is used to estimate the radiance of every pixel of the output image.

First Pass

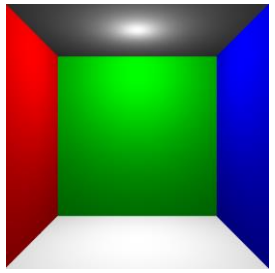


Second Pass

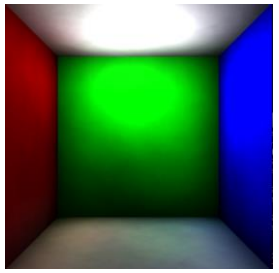


Final Results

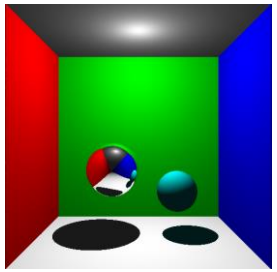
Cornell Box using Ray Tracing



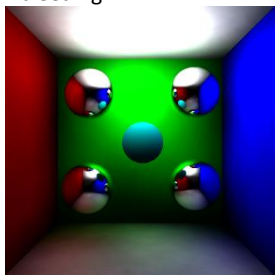
Cornell Box using Photon Mapping



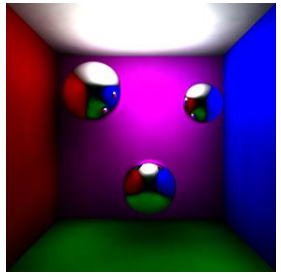
Ray Tracing with shadows



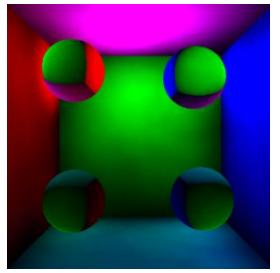
Photon Mapping, Color bleeding



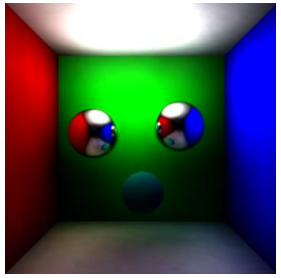
Reflection, Soft Shadows



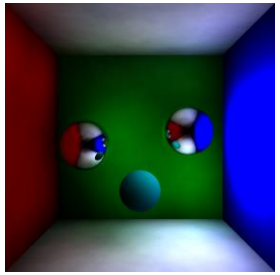
Refraction (Photon Mapping)



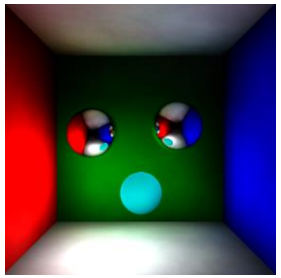
Light at top



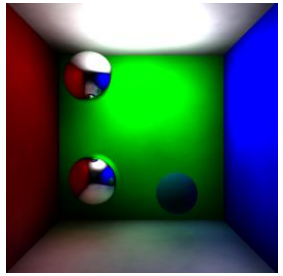
Light moved to center right



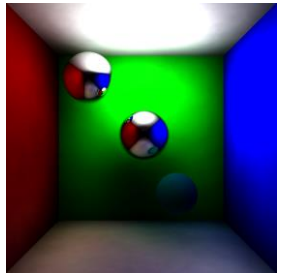
Light moved to bottom



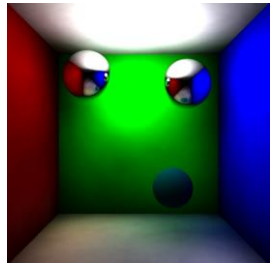
Object at bottom left



Object moved to middle)

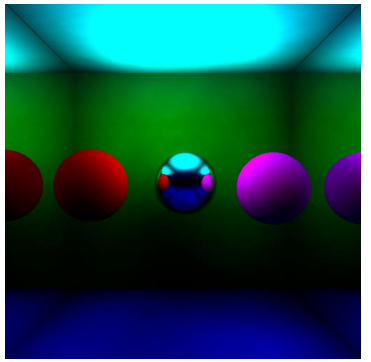


Object moved to top right

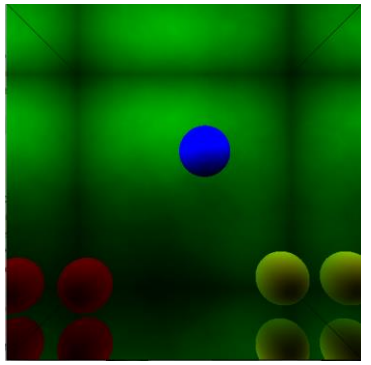


Additional Work

Reflecting effect on right and left wall



Reflecting effect on 4 walls



References

References

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(2) http://marctenbosch.com/photon/

(3)https://graphics.stanford.edu/courses/cs348b-01/course8.pdf

(4)http://citeseerx.ist.psu.edu/viewdoc/download?doi=10.1.1.300.6472&rep=rep1&type=pdf

(5)http://graphics.ucsd.edu/papers/photongfx/photongfx.pdf

Acknowledgements

Dr. Toler-Franklin for her guidance and assistance.